

The Family Triphoridae (Mollusca, Gastropoda) in Cuba. 4. The genera *Monophorus*, *Nototriphora*, *Cosmotriphora* and *Cheirodonta*, with the description of three new species

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ABSTRACT. New information on the species known of the genera studied are reported. One new species of the genus *Monophorus* and two of *Cheirodonta* are described.

RESUMEN. Se realizan nuevas aportaciones a las especies ya conocidas de los géneros estudiados y se describen tres especies nuevas, una del género *Monophorus* y dos de *Cheirodonta*.

INTRODUCTION

Following the publication of the first works on the family Triphoridae in Cuba, in which the species of the genera *Metaxia* Monterosato, 1884 (ROLAN & FERNANDEZ-GARCÉS, 1993a), *Iniforis* Jousseau, 1884 (ROLAN & FERNANDEZ-GARCÉS, 1993b) and *Isotriphora* (ROLAN & ESPINOSA, in press) were studied, we continue the revisory present work in which four genera are studied. New information on some of the previously known species is reported and three species new to science are described.

Additional material was recently examined from Bahamas Islands loaned by Colin Redfern, of Boca Raton, Fla. USA.

Abbreviations:

MNCN: Museo Nacional de Ciencias Naturales, Madrid

IES: Instituto de Ecología y Sistemática, La Habana

AMNH: American Museum of Natural History, New York

BMNH: The Natural History Museum, London

MNHN: Museum National d'Histoire Naturelle, Paris

ZMA: Zoologisch Museum, Amsterdam

RESULTS

SUBFAMILY TRIPHORINAE

Gray, 1847

Genus *Monophorus* Grillo, 1877

Monophorus olivaceus (Dall, 1889)

(Figs. 1-3, 6, 8, 30 MO)

= *ornatus* auct. non Deshayes, 1832

Material examined. NORTH OF CUBA: 3 specimens and 2 shells at 3 m, off the Hotel Comodoro, La Habana; 3 shells at 4 m, Jibacoa; 2 shells at 3 m, Baracoa. SOUTH OF CUBA: 6 shells at 17 m, Punta Pedernales; 4 shells at 15 m, Cayo Matías; 3 fragments at 15 m, Cayo Avalos, Archipiélago de Los Canarreos; 2 specimens and 16 shells at 3 m, Rancho Luna; and 20 shells and some fragments at 45 m, Cienfuegos Bay.

Description

Shell (Fig. 1-3) sinistral, oval-elongated with pointed apex and two or three nodulous cord on each whorl, the nodules being white or brown.

Protoconch (Fig. 6) of dark brown colour with three and a half whorls. On the first whorl there are tubercles with arrow-head shape. The other whorls have two spiral cords which are crossed by uninterrupted axial striae.

Teleoconch with about 10-12 whorls in larger specimens. The first whorls have two spiral cords from the beginning and, around the fifth or sixth whorl, a third cord begins between the previous two. This last cord is narrower, but it increases gradually to be similar to the lower one around the tenth whorl. Large and round nodules appear in the intersections of the axial ribs with the spiral cords. The colour is brown and white, the subsutural cord being brown with one white nodule between each two or three brown ones. The lower cord is always white. The intermediate cord has some white nodules and some brown. Under magnification, a very fine axial striation in the spaces between the cords and the ribs may be seen. Dimensions: the biggest shells can reach as much as 10 mm.

Animal a little translucent with variously sized spots formed by very small points of white-milk colour. The propodium has a yellowish colour marked in the anterior border of the foot.

Radula (Figs. 8 and 30 MO) with formula 15-1-1-1-15. The rachidian tooth has five cusps of similar size. The lateral tooth is very similar. The marginal teeth also have five cusps but the most peripheral have the external cusps shorter than the internal.

Remarks. FABER & MOOLENBEEK (1991) consider that the correct name for this species should be *Cosmotriphora olivacea* (Dall, 1889) instead of "*Triphora*" *ornata* Deshayes, 1832. Its position in the genus *Cosmotriphora* seems not adequate according to the characteristics of protoconch and radula: hemispherical tubercles in the protoconch and three cusps in the marginal teeth, in *Cosmotriphora*. In contrary to the other known species of *Monophorus*, the present one has an animal without red colour. However, for this reason we do not think that it should be placed in another genus and we agree with the opinion of BOUCHET (1984) on the generic value of the radula and protoconch in *Monophorus*.

Monophorus ateralbus n. sp.
(Figs. 4, 5, 7, 9, 30 MA)

Material examined. NORTH OF CUBA: 2 specimens at 2 m, Marianao Beach, and 7 shells at 4 m, off the Hotel Comodoro Beach, La Habana. SOUTH OF CUBA: 2 shells and 4 fragments with protoconch at 15 m, Cienfuegos Bay. BAHAMAS: 1 shell in beach drift, Abaco Island.

Description

Shell (Fig. 4-5) sinistral, with an oval-elongated form, a little wider near the base and with pointed apex.

Protoconch (Fig. 7) with four whorls and of uniform dark brown colour. The first whorl has T-form tubercles. The others have two spiral cords crossed without interruption by axial threads, which are a little irregular and slightly oblique in some parts.

Teleoconch with 7-9 whorls, which begins with two nodulous, spiral cords. These nodules are a little bigger in the lower cord. Around the sixth to seventh whorls a new spiral cord appears, situated near the upper one. In the body whorl, at the beginning, there are five nodulous cords, and near the anterior end, new spiral cords appear, there being eight by the end of the shell. Among these eight, the lower one is smaller, not nodulous and very close to the siphon. The aperture is rounded and the anal sinus is only slightly deeper but open. The siphonal canal is short, curved and closed by a fold from the external lip. The distribution of the dark brown and white colour in the teleoconch is in bands. The lower nodulous cord is white and the others are brown. This white nodulous cord ends in the anal sinus.

Dimensions between 3 and 6 mm, but the exact size of most of the collected specimens is difficult to determine because the shells with completed development of the body whorl are frequently decollated.

The **animal** has a whitish colour with numerous red-brown spots on the head and on the dorsum of the foot. The tentacles have very small white dots. There is a bigger white spot behind the head and additional spots on the posterior part of the foot. Laterally on the base of the tentacles, at the same level of the eyes, there is a small lateral prominence.

Radula (Figs. 9 and 30 MA) with formula 6-1-1-1-6. Rachidian tooth with five cusps from which two are longer. The lateral tooth has five cusps the smaller being most external. Marginal teeth have four cusps which are a little longer in the outermost ones.

Type material. Holotype (of 3.9 mm), MNCN, n° 15.05/11141; 1 paratype in IES, AMNH n° 226469, ZMA and 4 in the collections of R. Fernández-Garcés and E. Rolán.

Type locality: Marianao Beach, La Habana (Cuba).

Etymology. The specific name is due to the dark brown (almost black) and white banded coloration of the shell.

Remarks. *Monophorus ateralbus* n. sp. has a shell with brown and white spiral cords. Because of this kind of coloration, the shell must be compared with the following species: *Monophorus olivaceus* (Dall, 1889) has the spiral cords with the same colours but in each cord the nodules may be brown or white; also

different are the animal coloration and the radula. "*Triphora*" *intermedia* (C. B. Adams, 1850) has smaller and more numerous nodules and three spiral cords from the third whorl of teleoconch. "*Triphora*" *ellyae* De Jong & Coomans, 1988 has the position of the spiral cords inverted, the upper one being white and the same occurs with "*Triphora*" *elvirae* Jong & Coomans, 1988. *Iniforis turristhoniae* (Holten, 1802) has smaller nodules and a tubular anal hole far from the aperture. The differences of the shell with those of the *Cheirodonta verbernei* (Moolenbeek & Faber, 1989) and *C. decollata* n. sp. are based on the different position of the brown and white colour in the spiral cords in most parts of the teleoconch.

Genus *Nototriphora* Marshall, 1983

Nototriphora decorata
(C. B. Adams, 1850)
(Figs. 10, 14, 16, 30 ND)

Material examined. NORTH OF CUBA: 4 shells at 6 m, Jibacoa; 2 shells at 8 m, Herradura. SOUTH OF CUBA: 2 specimens and 4 shells between 4 and 20 m, Punta Francés, and 1 shell and 3 fragments between 20 and 50 m, Punta Pedernales, Isla de la Juventud; 10 shells at 15 m, Cayo Matías and 1 shell at 2 m, Cayo Diego Perez, Archipiélago de Los Canarreos; 6 specimens and 15 shells between 15 and 50 m, Cienfuegos Bay.

Description

Shell (Fig. 10): see ADAMS (1850) and CLENCH & TURNER (1950). This description should be complemented by the following information:

Protoconch (Fig. 14) of brown colour. It has between four and half to five spiral whorls. The first one with hemispheric tubercles very dense, the rest of the whorls with uninterrupted axial ribs crossed by one spiral cord in the first whorls and two in the lower. Near the anterior end both cords are fused into one.

The **teleoconch** presents a very fine, spiral striation in the spaces between the axial ribs, as mentioned by BOUCHET (1984).

Animal of hyaline white colour with very small white-milk spots irregularly distributed in the head and the dorsal part of the foot. Tentacles translucent. GARCIA & LUQUE (1986) mention the presence of some red spots on the flanks near the operculum; we could not find these red spots in several animals examined. We think that it is not a constant character.

Operculum rounded, with a central nucleus and a translucent yellowish-white colour.

Radula (Figs. 16 and 30 ND) with formula 18-1-1-1-18. The rachidian tooth has three equal cusps. The lateral tooth has five cusps, of which the second one is less prominent. The first marginal tooth has four cusps, the two central ones being filiform. The rest of the marginal teeth have three cusps the central one being longer and narrower.

Remarks. Some shells collected in Cienfuegos present a violet coloration instead of brown, alternating with white. As we can not find any other differences, this coloration must be considered as an ecological variation.

Genus *Cosmotriphora*

Olsson & Harbison, 1953

Cosmotriphora melanura
(C. B. Adams, 1850)
(Figs. 11, 25, 26, 30 CM)

Material examined. NORTH OF CUBA: 5 shells at 10 m, Herradura; 5 shells at 4 m, Jibacoa; 3 shells at 4 m, off the Hotel Comodoro Beach, La Habana; 2 shells at 6 m, Baraoea. SOUTH OF CUBA: 6 shells between 8 and 17 m, Cayo Matías, Archipiélago de Los Canarreos; 4 shells at 50 m, Punta Pedernales, Isla de la Juventud; 40 shells between 10 at 20 m, Cienfuegos Bay.

Description

Shell (Fig. 11), see BOUCHET (1984). It has been figured by BOUCHET (1984, p. 36, fig. 27) and by FERNANDES & ROLAN (1986, pl. 1, fig. 1, pl. 2, fig. 1), for specimens from the eastern Atlantic. WARMKE & ABBOTT (1961, pl. 13, fig. 1) and ABBOTT (1974, fig. 1132) showed Caribbean specimens. The radula is drawn in BOUCHET (1984, fig. 16). The protoconch of a shell from Cuba is represented in the Fig. 25.

Animal of opalescent whitish colour with numerous white spots which are slightly yellowish in the propodium. Behind the eyes there are subcutaneous yellow areas.

Radula (Figs. 26 and 30 CM) with formula 10-1-1-1-10. It has a rachidian tooth and very similar lateral teeth, each one with four cusps. Marginal teeth have three cusps: the inner ones have their three cusps of almost equal size, while the external ones have their lateral cusps shorter and the central one longer. In the most external, the central cusp becomes filiform.

Remarks. This species is variable in size: the smallest shell is only 4 mm while others can be as much as 10 mm. The normal white coloration can become cream in some specimens. The shells from the Caribbean have been compared with specimens from Ghana and Cape Verde Islands, showing small differences: in the African shells, the third spiral cord of the teleoconch begins between the 6th and 8th whorl and always has smaller nodules than those of the other cords, except in the body whorl. On the other hand, in the shells from the Caribbean, the third spiral cord begins around the 3rd whorl and, between the 6th and the 8th, it is of similar size to the other two. Nevertheless, these differences seem not enough to consider both populations in different specific position. The protoconchs are equal and the radulas, after the examination of several specimens from Cuba and Ghana, have no significant differences. So, the observation of BOUCHET (1984) in relation to the marginal external teeth is not confirmed. It is considered an amphiatlantic species.

Cosmotriphora arnoldoi
Faber & Moolenbeek, 1991
(Figs. 12, 13, 15)

Material examined. 5 shells and 3 fragments at 20 m, Cienfuegos Bay.

Description

Shell, see FABER & MOOLENBEEK (1991). In the Figs. 12 and 13 shells are shown with normal colour distribution which was not evident in original figures because a SEM-photograph was used. Dimensions: although the holotype is of a size smaller than 3 mm, some shells from our material reach 6 mm and have 10 whorls (Fig. 12).

Remarks. In FABER & MOOLENBEEK (1991) the assignation of this species to the genus *Cosmotriphora* is not explained. Perhaps it could be on similarity of its protoconch with that of *Cosmotriphora melanura*. The lack of knowledge about the radula and operculum makes this assignation only a provisional effort.

Genus *Cheirodonta* Marshall, 1983

Cheirodonta verbernei
(Moolenbeek & Faber, 1989)
(Figs. 17, 18, 22, 30 CV)

Material examined. 1 specimen, 5 shells and 2 fragments with protoconch, in sediments at 25 m, Cienfuegos Bay.

Description

Shell (Figs. 17 and 18), see MOOLENBEEK & FABER (1989). Some shells of our material are similar to the description of the holotype, in which a brown colour with knobs of a lighter shade is mentioned. Other specimens have a lighter lower cord in the penultimate whorl and, in the body whorl, the upper one white.

The **protoconch** (Fig. 22), has the apex covered with hemispheric tubercles (it can be observed in the picture in spite of a fracture) and it is not smooth, as is mentioned in the description of the holotype, which has this part polished by erosion.

Animal translucent white with milk-white spots irregularly distributed on the dorsum.

The **radula** (Fig. 30 CV), studied from one live collected specimen and partially destroyed during the protographic process, showed a rachidian tooth with two cusps at each side and a lateral tooth with shortish cusps.

The **operculum** is rounded, light yellow, translucent, with a central nucleus, the external border obliquely elevated outwards and with a small depression in the centre of the internal part.

Remarks. The inclusion of this species in the genus *Cheirodonta* is based on the radular characteristics, similar to the *Cheirodonta labiata* (see MARSHALL, 1983, fig. 8 C) and *C. pallescens* (see BOUCHET, 1984, fig. 10-11).

Cheirodonta decollata n. sp.
(Figs. 19, 20, 21, 23, 24, 30 CD)

Material examined. NORTH OF CUBA: 8 specimens at 2 m, Marianao Beach, and 1 specimen at 3 m, Marina Hemingway, La Habana; 1 specimen and 6 shells at 3 m, Baracoa. SOUTH OF CUBA: 8 specimens and 10 shells at 3 m, Rancho Luna, 1 specimen, Cable Inglés and 8 shells at 10 m, Cienfuegos Bay.

Description

Shell (Figs. 19, 20 and 21) sinistral, ovoid-elongated, slightly pyriform, usually with the protoconch lost (only present in 1/6 of the shells studied).

Protoconch (Fig. 23) with about four whorls. The first whorl is covered by hemispheric tubercles; the rest have two spiral cords crossed by axial ribs. Dark brown colour.

Teleoconch with seven or eight whorls which present two spiral cords with rounded and rather big nodules, being slightly larger in the upper cord. On the last whorls these cords are separated, especially in the penultimate one.

In the beginning of the body whorl there are five cords, a new one appearing below the upper one. At the end of the spire there are seven or eight cords by the presence of several others. The axial ribs between the nodules are a little oblique, being more evident in the lower whorls. Towards the end of the body whorl the axial ribs are slighter and more closed; at the same time, the spiral cords are finer, bifurcated and attenuated, almost disappearing near the free border. The aperture has the form of an inverted arc; the anal sinus is deep but open. The siphon is short, curved and closed by a fold of the external lip. There is a microsculpture of microscopic tubercles spirally aligned. The coloration is very characteristic and constant: the two first whorls of the teleoconch are of a cream colour but with the subsutural cord brown. From the second whorl, both nodulous cords change to uniform brown, but from the 5th whorl can be observed that the nodules of the upper cord are slightly bigger and whitish. This white colour is more evident in the penultimate whorl. In the body whorl the upper cord is bifurcated, a finer cord appearing below. The colour of the upper cord continues white until the end where its nodules are smaller and brown, finishing in the anal sinus. The base is brown.

Animal translucent white with opaque spots formed by very small white-milk dots. Tentacles translucent.

Operculum white, translucent, multispiral and with a central nucleus.

Radula (Figs. 24 and 30 CD) with formula 7-1-1-1-7. Rachidian tooth with 9 cusps of which the central one is shorter. Lateral tooth with 8 shortish cusps. Marginal teeth of comb-like form with elongated cusps.

Dimensions. The holotype is 3.95 mm of length. Other specimens with protoconch are slightly smaller. In most shells it is not possible to know the real size due to their decollation.

Type material. Holotype of 3.95 mm and one paratype, in MNCN n° 15.05/11142. Two paratypes each in IES, AMNH n° 226470, BMNH n° 1993062, MNHN, ZMA and 11 paratypes in the collections of R. Fernández-Garcés and E. Rolán.

Type locality. Marianao Beach, La Habana.

Habitat. On rocky bottoms, under rocks or outside of the coral barrier, under dead corals.

Etymology. The species is named after the fact that it loses its apex during maturity.

Remarks. The shell of *Cheirodonta decollata* n. sp. at a superficial look may remind one of *Monophorus ateralbus* n. sp. but this last species has the lower cord white instead of brown. Also there are differences in the

microsculpture of the protoconch and the radula when these characters can be studied. From *Cheirodonta verbernei* (Moolenbeek & Faber, 1989) it must be differentiated because this latter species has the first whorls of the teleoconch of uniform brown colour instead of cream with a brown cord. Also, *C. verbernei* has the lower cord white in the penultimate whorl, and the white colour of the nodules is less evident.

This species was also collected in Bahamas (Redfern, pers. com.).

Cheirodonta apexcrassum n. sp.
(Figs. 27, 28, 29)

Material examined. NORTH OF CUBA: 4 shells and 9 fragments with protoconch, in sediments at 7 m, Jibacoa. BAHAMAS: 3 shells at 10 m, Chub Rocks, Abaco Island.

Description

Shell (Figs. 27 and 28) sinistral, ovoid-elongated, a little pyriform.

Protoconch (Fig. 29) relatively large, with uniform brown colour. It begins with a well-differentiated nucleus in a vertical position, and consists of between 2 and 2 1/2 spiral whorls. These whorls present two prominent spiral cords which are irregular at the beginning and nodulous after. Another small cord is on the suture. At the end of the protoconch both cords are fused in one. The beginning of the teleoconch is ill-defined.

Teleoconch with 5-6 whorls. It begins with the lower cord a continuation of the only cord of the protoconch. Later, the upper cord appears smaller, but increasing quickly and achieving the same size as the lower one. Both have evident nodules which are connected by axial ribs. Towards the fourth whorl a new cord appears between the last ones, nearer the upper one and with smaller knobs. On the body whorl there are six cords from which the three upper ones are nodulous, the three lower being smooth. Aperture slightly ovoid with a prominent cutting external lip and a superior open anal sinus. In the base there is a fold which closes the siphonal canal. The siphon is short and curved. The columellar lip has a basal prominence towards the beginning of the siphonal canal and another up near the sinus. Coloration is almost uniform brown, the upper cord a little lighter in the last whorls and also lighter in the external lip of the aperture.

Type material. Holotype (Fig. 27) of 2.78 mm, in MNCN n° 15.05/11143. One paratype each in IES, AMNH n° 226471, BMNH n° 1993061, ZMA, MNHN and the collection of R.

Fernández-Garcés; three (from Abaco) in that of Redfern and six in that of E. Rolán.

Type locality. Jibacoa, in North of Cuba.

Etymology. The specific name makes reference to the thickness of the protoconch.

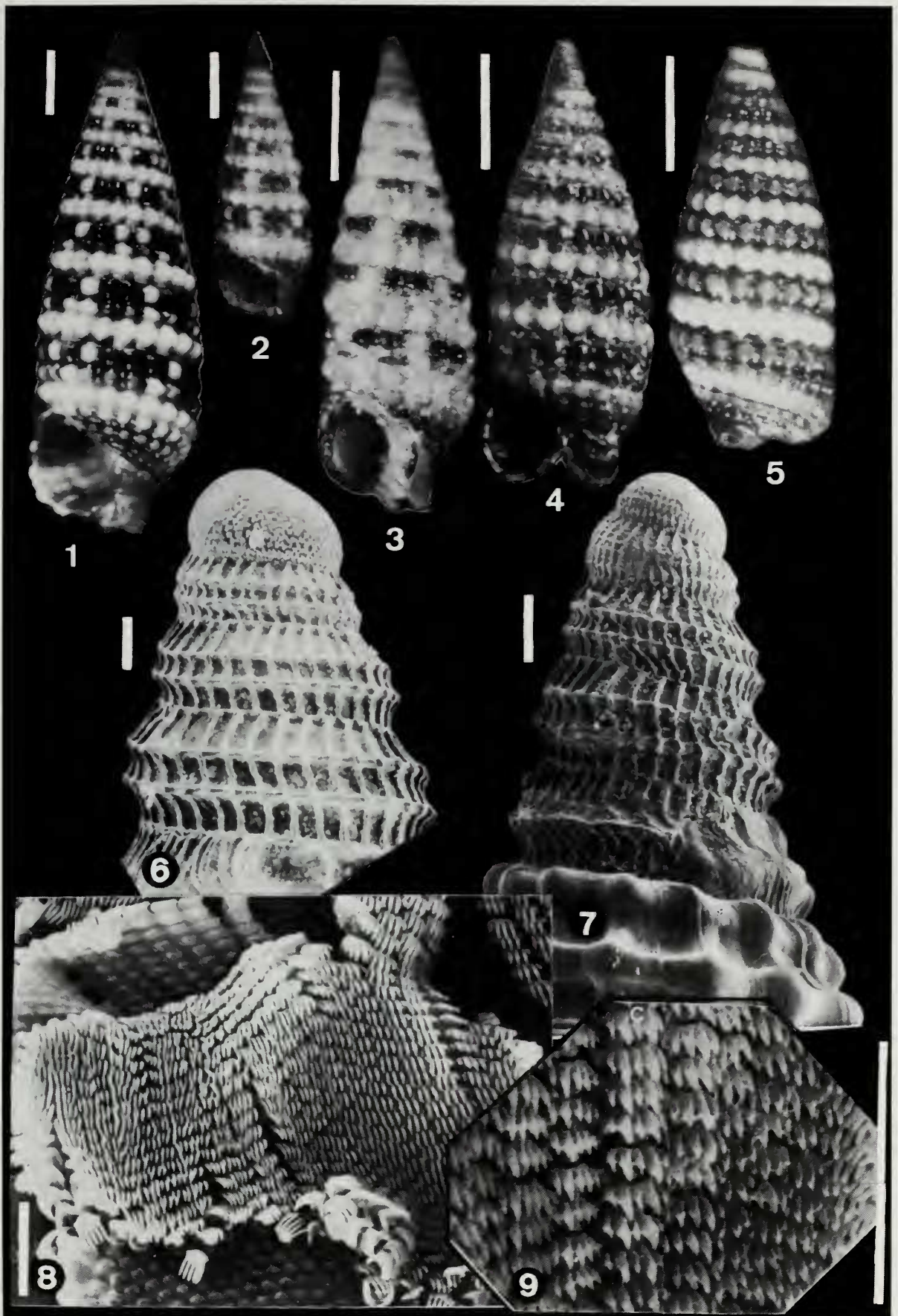
Remarks. The position of the present species in the genus *Cheirodonta* is only tentative, based on the great similarity (shell and protoconch) with the species shown by MARSHALL (1983), *Cheirodonta labiata* (A. Adams, 1851) from Australia.

Cheirodonta apexcrassum n. sp. can be differentiated from "*Triphora*" *calva* Faber & Moolenbeek, 1991 because this last species has a smaller protoconch and smaller nucleus; also lacks the two constant cords of the protoconch. It differs from the other species of the genus described in the present work by having a paucispiral protoconch.

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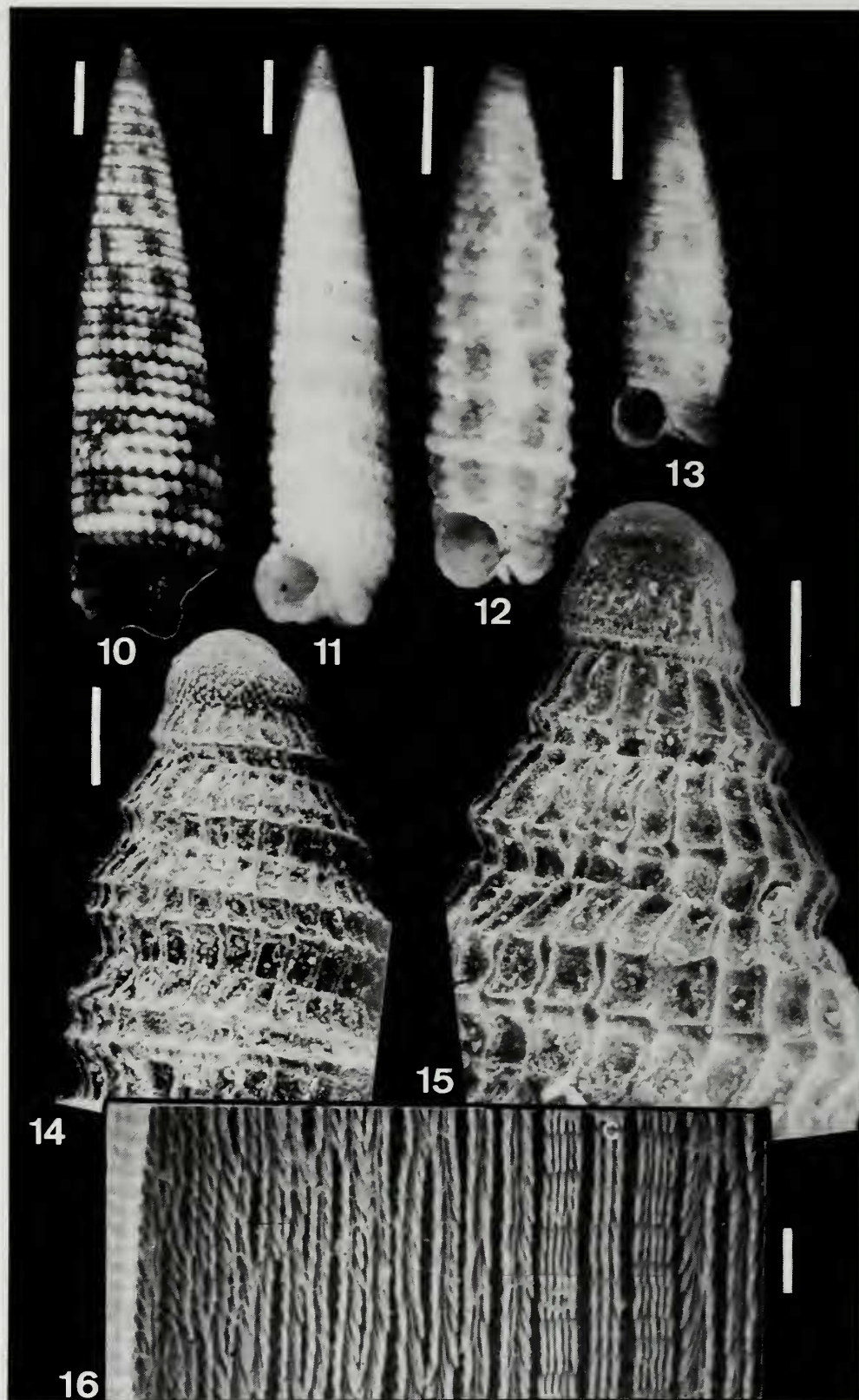
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Figs. 1-9.

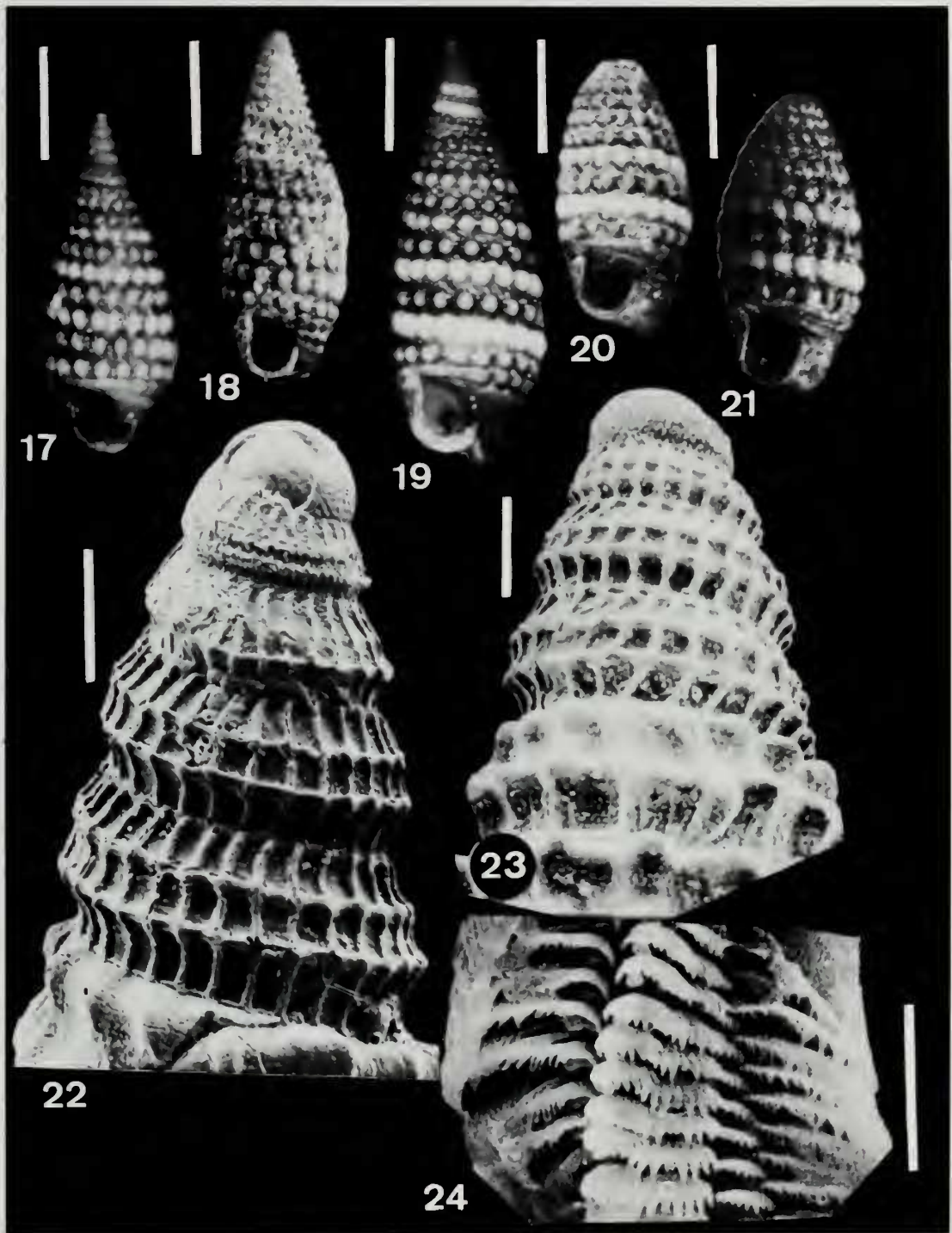
1-3. *Monophorus olivaceus*; 4. *Monophorus ateralbus* n. sp. Holotype (MNCN);
 5. *Monophorus ateralbus* n. sp. Paratype (coll. E. Rolán); 6. *Monophorus olivaceus*.
 Protoconch; 7. *Monophorus ateralbus*. Protoconch; 8. *Monophorus olivaceus*. Radula.
 9. *Monophorus ateralbus* n. sp. Radula.
 (scale bar: shells: 1 mm; protoconchs: 0.1 mm; radulas 0.01 mm)



Figs. 10-16.

10. *Nototriphora decorata*; 11. *Cosmotriphora melanura*; 12. *Cosmotriphora arnoldoi*;
 13. *Cosmotriphora arnoldoi*; 14. *Nototriphora decorata*. Protoconch; 15. *Cosmotriphora arnoldoi*. Protoconch; 16. *Nototriphora decorata*. Radula.

(scale bar: shells: 1 mm; protoconchs: 0.1 mm; radulas 0.01 mm)

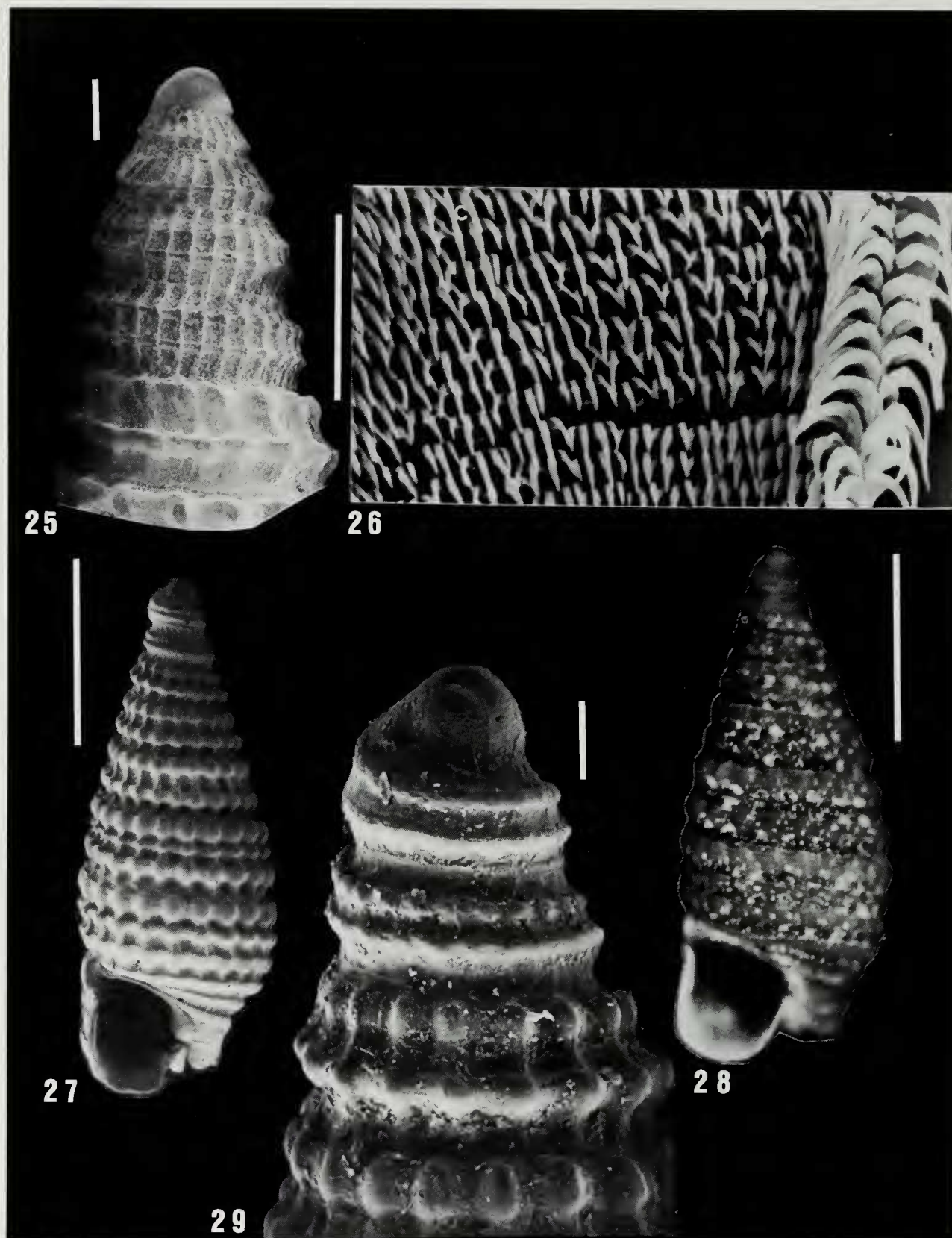


Figs. 17-24.

17-18. *Cheirodonta verbernei*; 19. *Cheirodonta decollata* n. sp. Holotype (MNCN).

20-21. *Cheirodonta decollata* n. sp. Paratypes (col. E. Rolán); 22. *Cheirodonta verbernei*. Protoconch; 23. *Cheirodonta decollata* n. sp. Protoconch; 24. *Cheirodonta decollata* n. sp. Radula.

(scale bar: shells: 1 mm; protoconchs: 0.1 mm; radulas 0.01 mm)



Figs. 25-29.

25. *Costrotriphora melanura*. Protoconch; 26. *Costrotriphora melanura*. Radula. C central tooth; 27. *Cheiodonta apexcrassum* n. sp. Holotype (MNCN); 28. *Cheiodonta apexcrassum* n. sp. Paratype (Col. E. Rolán); 29. *Cheiodonta apexcrassum* n. sp. Protoconch. (scale bar: shells: 1 mm; protoconchs: 0.1 mm; radulas 0.01 mm)

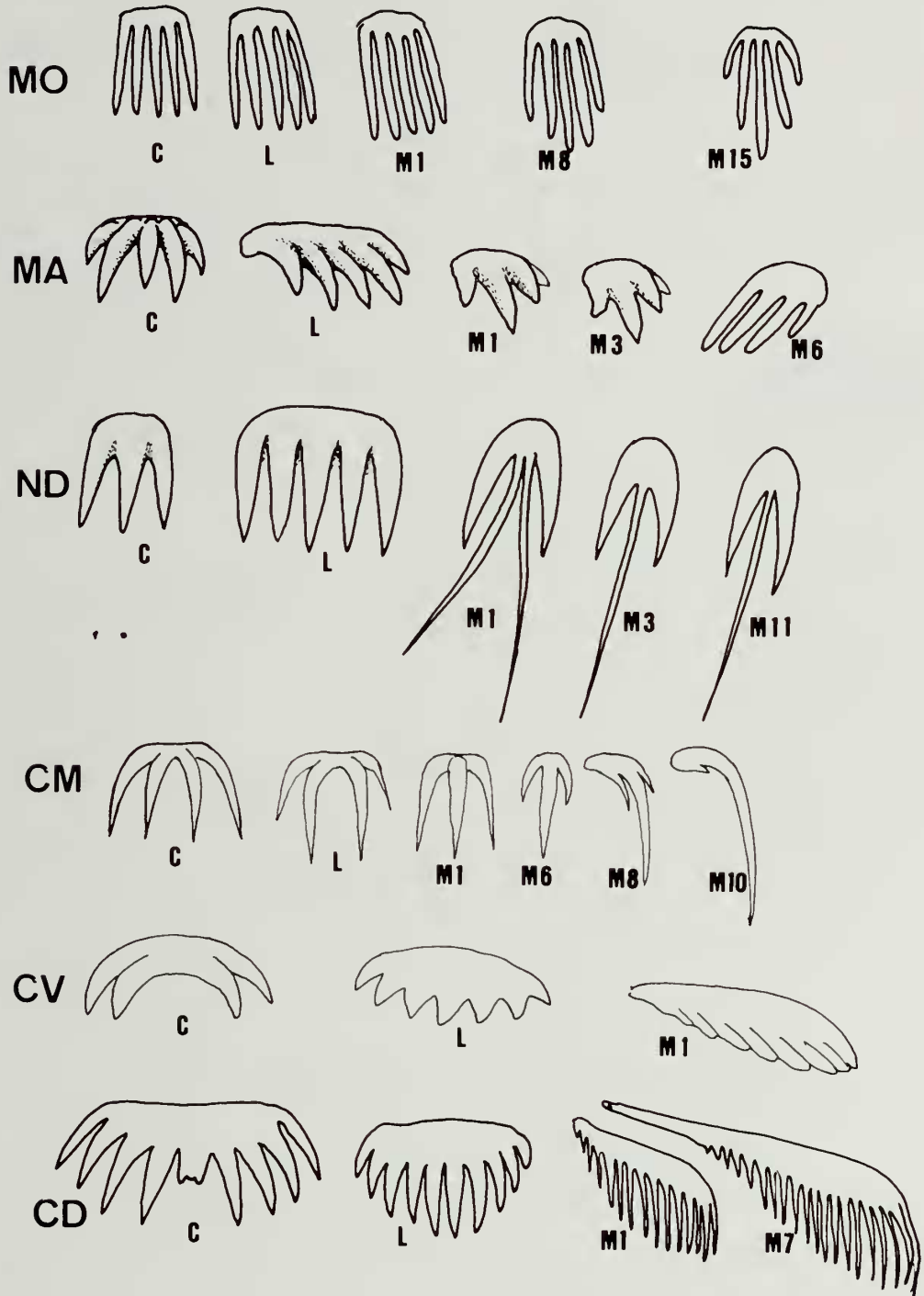


Fig. 30.- Radular teeth:

MO: *Monophorus olivaceus*; MA: *Monophorus ateralbus*; ND: *Nototriphora decorata*
 CM: *Cosmotriphora melanura*; CV: *Cheirodonta verbernei*; CD: *Cheirodonta decollata*
 C- rachidian tooth; L- lateral tooth; M1-2-etc.- marginal teeth.